



TFT LCD Preliminary Specification

MODEL NO.: V400H1 - LH5

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**REVISION HISTORY**

Version	Date	Page (New)	Section	Description
Ver 1.0	Nov. 07,'08	All	All	Preliminary Specification was first issued.

1. GENERAL DESCRIPTION

1.1 OVERVIEW

V400H1- LH5 is a 40" TFT Liquid Crystal Display module with 14-CCFL Backlight unit and 2ch-LVDS interface. This module supports 1920 x 1080 FHD format and can display true 1G colors (10-bits/color). The inverter module for backlight is built-in.

1.2 FEATURES

- High brightness (500 nits)
- Ultra-high contrast ratio (5000:1)
- Faster response time (Gray to gray average 6.5ms)
- High color saturation NTSC 72%
- Ultra wide viewing angle : 176(H)/176(V) (CR>20) with Super MVA technology
- DE (Data Enable) only mode
- LVDS (Low Voltage Differential Signaling) interface
- Color reproduction (nature color)
- Optimized response time for both 50/60 Hz Frame rate
- Low color shift function
- RoHS compliance

1.3 APPLICATION

- TFT LCD TVs
- Multi-Media Display

1.4 GENERAL SPECIFICATIONS

Item	Specification	Unit	Note
Active Area	885.6(H) x 498.15 (V) (40" diagonal)	mm	(1)
Bezel Opening Area	891.7 (H) x 504.2 (V)	mm	
Driver Element	a-si TFT active matrix	-	
Pixel Number	1920 x R.G.B. x 1080	pixel	
Pixel Pitch (Sub Pixel)	0.15375 (H) x 0.46125 (V)	mm	
Pixel Arrangement	RGB vertical stripe	-	
Display Colors	1G	color	
Display Operation Mode	Transmissive mode / Normally black	-	
Surface Treatment	Anti-Glare coating (SC), Hard coating (3H)	-	

1.5 MECHANICAL SPECIFICATIONS

Item		Min.	Typ.	Max.	Unit	Note
Module Size	Horizontal(H)	951	952	953	mm	(1)
	Vertical(V)	550	551	552	mm	(1)
	Depth(D)	39.5	40.5	41.5	mm	To TOP Side
	Depth(D)	49	50	51	mm	To PCB Cover
Weight		-	9550	-	g	

Note (1) Please refer to the attached drawings for more information of front and back outline dimensions.

2. ABSOLUTE MAXIMUM RATINGS

2.1 ABSOLUTE RATINGS OF ENVIRONMENT

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Storage Temperature	T _{ST}	-20	+60	°C	(1)
Operating Ambient Temperature	T _{OP}	0	+50	°C	(1), (2)
Shock (Non-Operating)	S _{NOP}	-	50	G	(3), (5)
Vibration (Non-Operating)	V _{NOP}	-	1.0	G	(4), (5)

Note (1) Temperature and relative humidity range is shown in the figure below.

(a) 90 %RH Max. ($T_a \leq 40\text{ }^{\circ}\text{C}$).

(b) Wet-bulb temperature should be 39 °C Max. ($T_a > 40\text{ }^{\circ}\text{C}$).

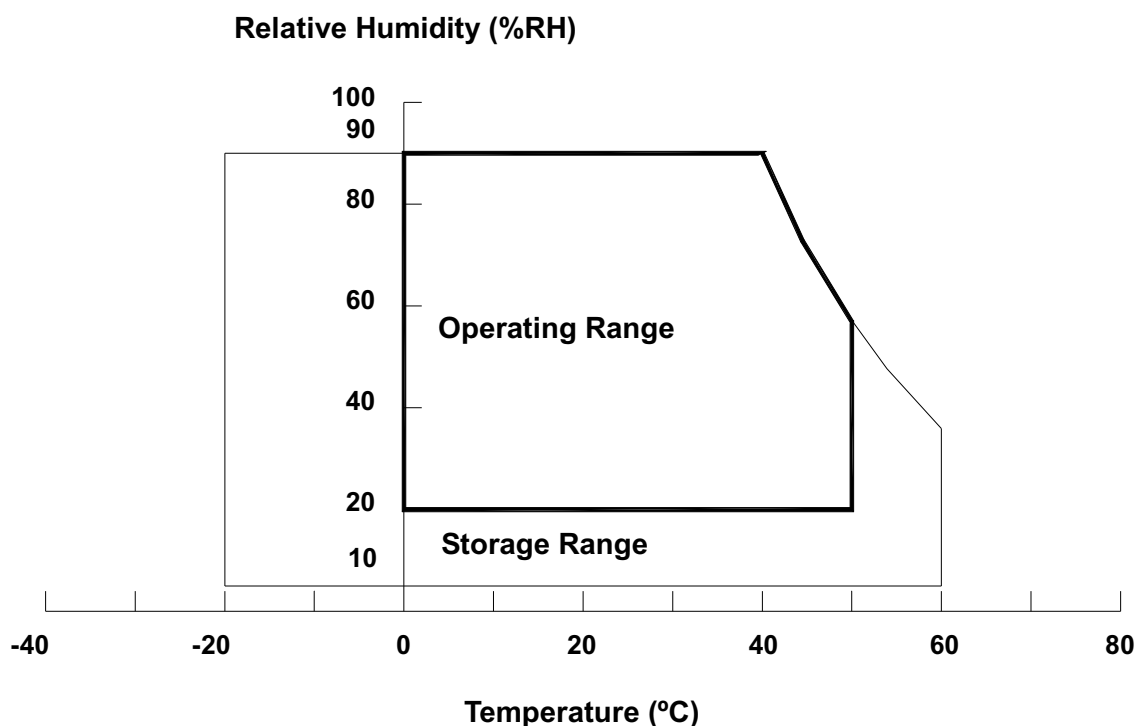
(c) No condensation.

Note (2) The maximum operating temperature is based on the test condition that the surface temperature of display area is less than or equal to 65 °C with LCD module alone in a temperature controlled chamber. Thermal management should be considered in final product design to prevent the surface temperature of display area from being over 65 °C. The range of operating temperature may degrade in case of improper thermal management in final product design.

Note (3) 11 ms, half sine wave, 1 time for $\pm X$, $\pm Y$, $\pm Z$.

Note (4) 10 ~ 200 Hz, 10 min, 1 time each X, Y, Z.

Note (5) At testing Vibration and Shock, the fixture in holding the module has to be hard and rigid enough so that the module would not be twisted or bent by the fixture.





2.2 PACKAGE STORAGE

When storing modules as spares for a long time, the following precaution is necessary.

- (a) Do not leave the module in high temperature, and high humidity for a long time. It is highly recommended to store the module with temperature from 0 to 35 °C at normal humidity without condensation.
- (b) The module shall be stored in dark place. Do not store the TFT-LCD module in direct sunlight or fluorescent light.

2.3 ELECTRICAL ABSOLUTE RATINGS

2.3.1 TFT LCD MODULE

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Power Supply Voltage	V _{CC}	-0.3	13.5	V	(1)
Input Signal Voltage	V _{IN}	-0.3	3.6	V	

2.3.2 BACKLIGHT UNIT

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Lamp Voltage	V _W	—	3000	V _{RMS}	

Note (1) No moisture condensation or freezing.

3. ELECTRICAL CHARACTERISTICS

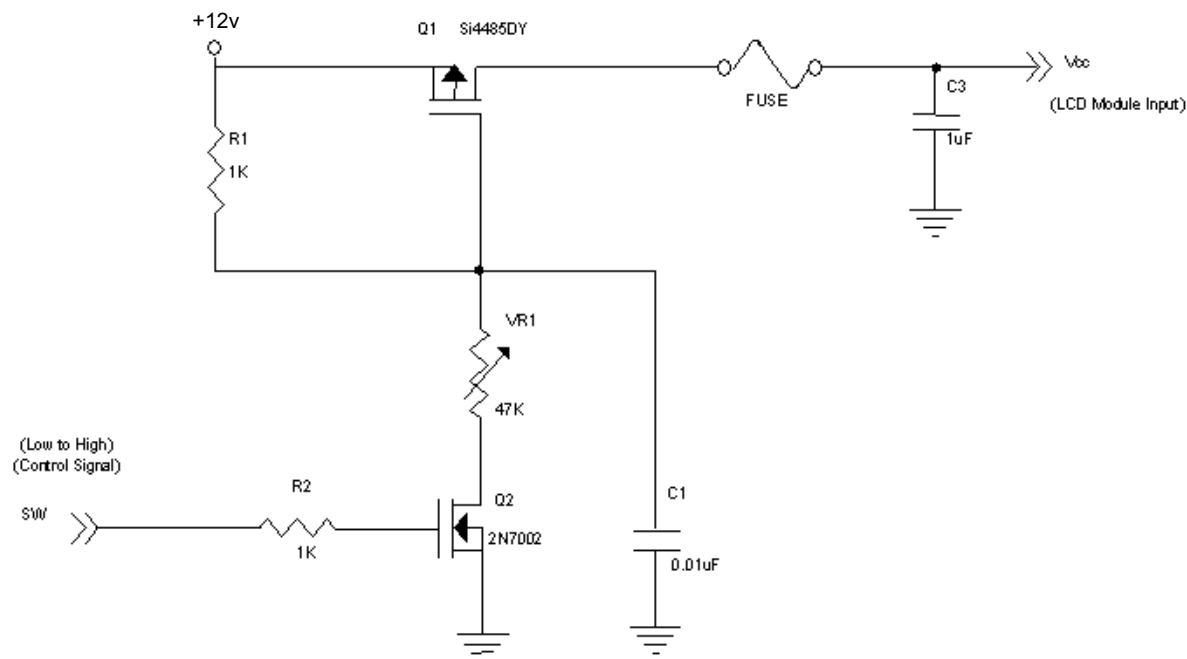
3.1 TFT LCD MODULE

Ta = 25 ± 2 °C

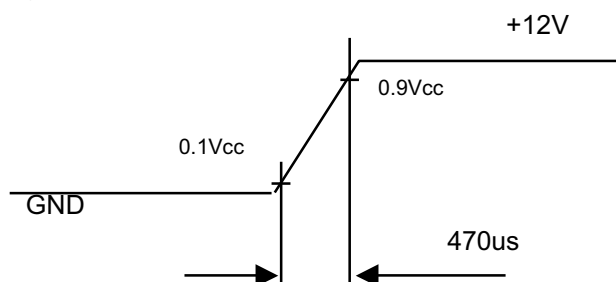
Parameter		Symbol	Value			Unit	Note
			Min.	Typ.	Max.		
Power Supply Voltage		V _{CC}	10.8	12.0	13.2	V	(1)
Power Supply Ripple Voltage		V _{RP}	-	-	350	mV	
Rush Current		I _{RUSH}	-	-	4.5	A	(2)
Power Supply Current	White	I _{CC}	-	2.6	2.8	A	(3)
	Black		-	2	2.1	A	
	Vertical Stripe		-	2.6	2.9	A	
LVDS Interface	Common Input Voltage	V _{LVC}	1.125	1.25	1.375	V	
	Terminating Resistor	R _T	-	100	-	ohm	
CMOS interface	Input High Threshold Voltage	V _{IH}	2.7	-	3.3	V	
	Input Low Threshold Voltage	V _{IL}	0	-	0.7	V	

Note (1) The module should be always operated within above ranges.

Note (2) Measurement Conditions:

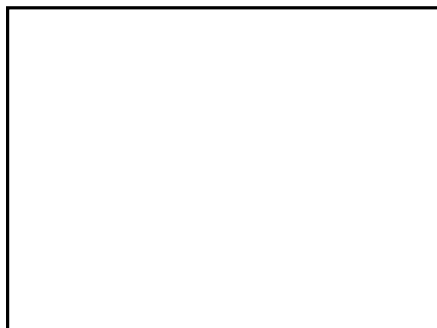


Vcc rising time is 470us



Note (3) The specified power supply current is under the conditions at $V_{CC} = 12\text{ V}$, $T_a = 25 \pm 2\text{ }^{\circ}\text{C}$, $f_v = 60\text{ Hz}$, whereas a power dissipation check pattern below is displayed.

a. White Pattern



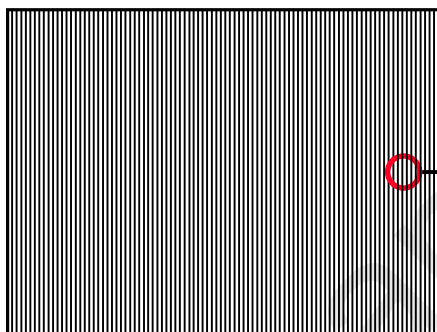
Active Area

b. Black Pattern

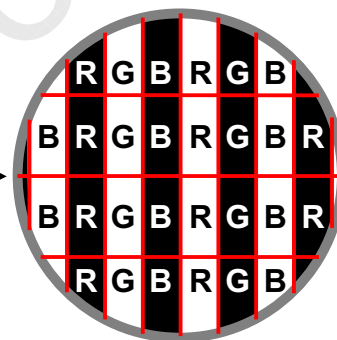


Active Area

c. Vertical Stripe Pattern



Active Area



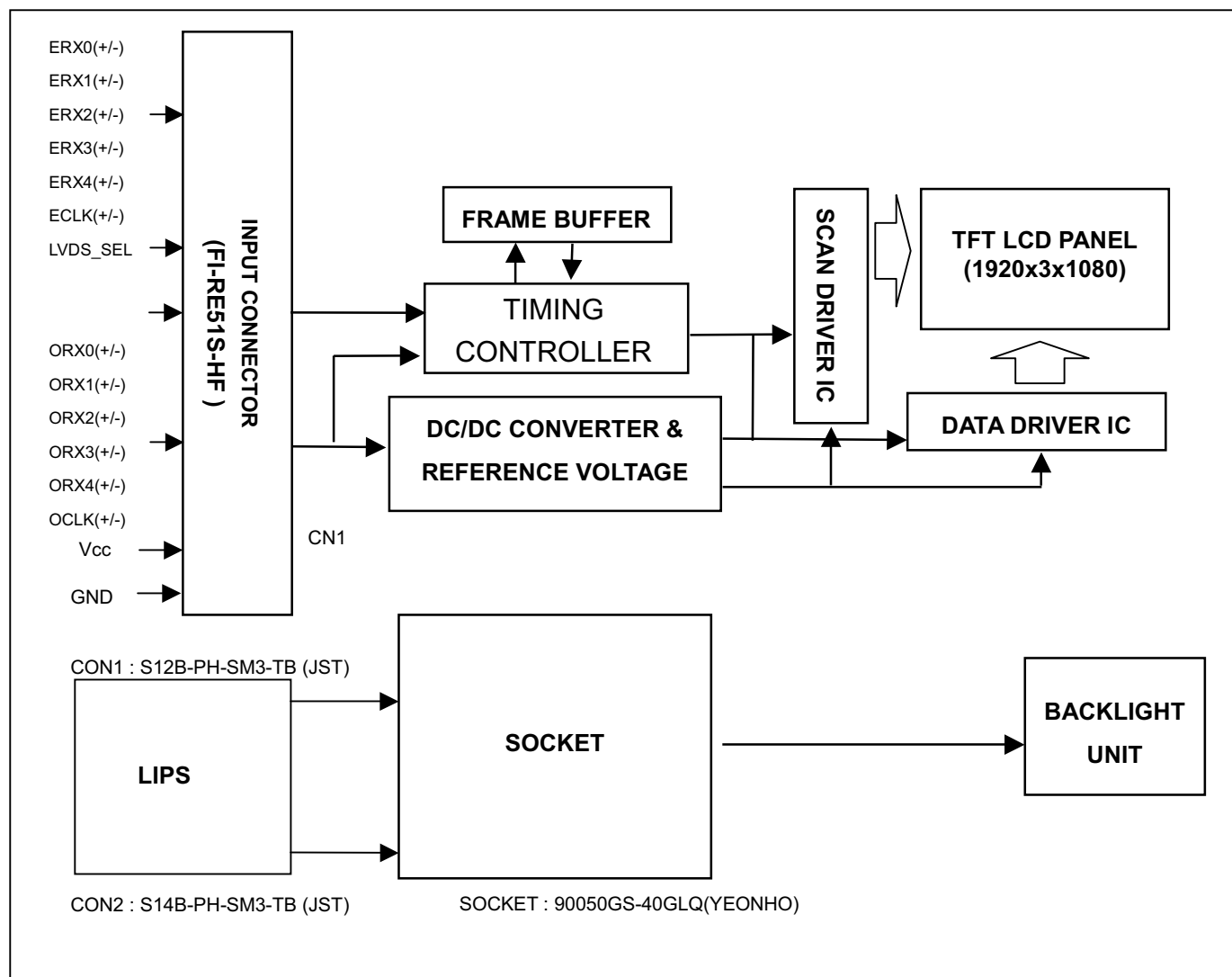
3.2 BACKLIGHT UNIT

3.2.1 CCFL (Cold Cathode Fluorescent Lamp) CHARACTERISTICS ($T_a = 25 \pm 2\text{ }^{\circ}\text{C}$)

Parameter	Symbol	Value			Unit	Note
		Min.	Typ.	Max.		
Lamp Voltage	V_W	-	1020	-	V_{RMS}	$I_h = 11.0\text{mA}$
Lamp Current	I_L	10.7	11.0	11.3	mA_{RMS}	(1)
Lamp Starting Voltage	V_s	-	-	1680	V_{RMS}	(2), $T_a = 0\text{ }^{\circ}\text{C}$
		-	-	1400	V_{RMS}	(2), $T_a = 25\text{ }^{\circ}\text{C}$
Operating Frequency	F_O	30	-	80	kHz	(3)
Lamp Life Time	L_{BL}	50,000	-	-	Hrs	(4), at 11.5mA

4. BLOCK DIAGRAM

4.1 TFT LCD MODULE





5. INTERFACE PIN CONNECTION

5.1 TFT LCD MODULE

CN505 Connector Pin Assignment

Pin No.	Symbol	Description
1	VIN	+12.0V power supply
2	VIN	+12.0V power supply
3	VIN	+12.0V power supply
4	VIN	+12.0V power supply
5	VIN	+12.0V power supply
6	NC	No connection
7	GND	Ground
8	GND	Ground
9	GND	Ground
10	ODD_RIN0N	Negative transmission data of First pixel 0
11	ODD_RIN0P	Positive transmission data of First pixel 0
12	ODD_RIN1N	Negative transmission data of First pixel 1
13	ODD_RIN1P	Positive transmission data of First pixel 1
14	ODD_RIN2N	Negative transmission data of First pixel 2
15	ODD_RIN2P	Positive transmission data of First pixel 2
16	GND	Ground
17	ODD_RINCLKN	Negative of First clock
18	ODD_RINCLKP	Positive of First clock
19	GND	Ground
20	ODD_RIN3N	Negative transmission data of First pixel 3
21	ODD_RIN3P	Positive transmission data of First pixel 3
22	ODD_RIN4N	Negative transmission data of First pixel 4
23	ODD_RIN4P	Positive transmission data of First pixel 4
24	GND	Ground
25	EVEN_RIN0N	Negative transmission data of Second pixel 0
26	EVEN_RIN0P	Positive transmission data of Second pixel 0
27	EVEN_RIN1N	Negative transmission data of Second pixel 1
28	EVEN_RIN1P	Positive transmission data of Second pixel 1
29	EVEN_RIN2N	Negative transmission data of Second pixel 2
30	EVEN_RIN2P	Positive transmission data of Second pixel 2
31	GND	Ground
32	EVEN_RINCLKN	Negative of Second clock
33	EVEN_RINCLKP	Positive of Second clock
34	GND	Ground
35	EVEN_RIN3N	Negative transmission data of Second pixel 3
36	EVEN_RIN3P	Positive transmission data of Second pixel 3
37	EVEN_RIN4N	Negative transmission data of Second pixel 4
38	EVEN_RIN4P	Positive transmission data of Second pixel 4
39	GND	Ground
40	SCL_I	SEC define
41	SDA_I	SEC define



42	TCON_CHECK	SEC define
43	TST_PGM	SEC define
44	HSYNC	SEC define
45	LVDS_SEL	SEC define
46	I2C_SCL	SEC define
47	FRC_NRESET	SEC define
48	I2C_SDA	SEC define
49	SW_PVCC	SEC define
50	MAIN_CHECK	SEC define
51	NC	No connection

Note (1) CN505 Connector Part No.: JAE Taiwan (台灣航空電子) FI-RE51S-HF or equal.

**CHI MEI**
OPTOELECTRONICS CORP.Issued Date: Nov. 07, 2008
Model No.: V400H1 - LH5**Preliminary**

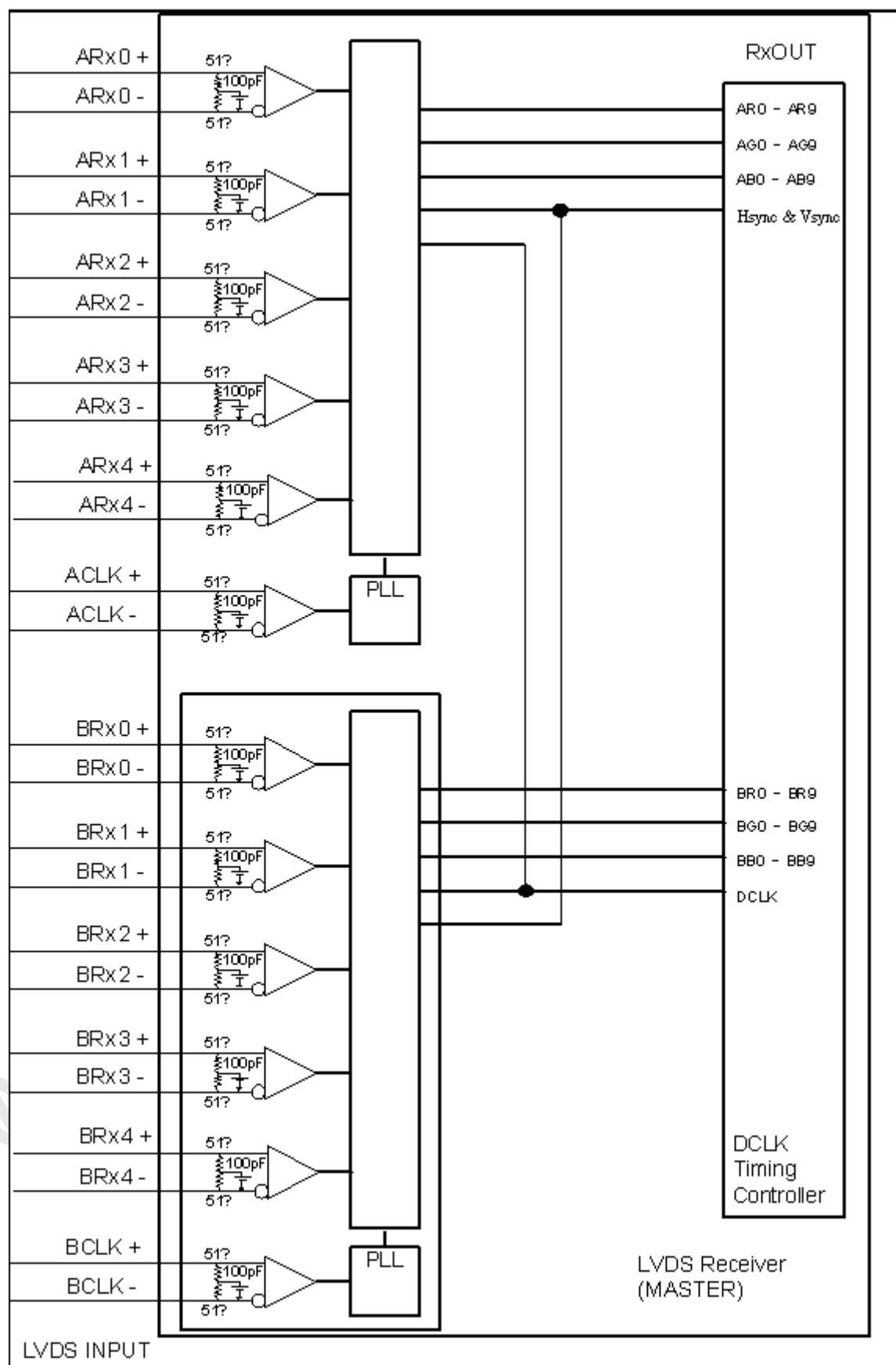
5.2 BACKLIGHT UNIT

The pin configuration for the housing and leader wire is shown in the table below.

Pin No.	Symbol	Description	Wire Color
NA	NA	NA	NA

Note (1) The backlight interface housing for high voltage side is a model 90050GS-40GLQ (SOCKET), manufactured by YEONHO.



5.3 BLOCK DIAGRAM OF INTERFACE

ER0~ER9 : Even pixel R data

EG0~EG9 : Even pixel G data

EB0~EB9 : Even pixel B data

OR0~OR9: Odd pixel R data

OG0~OG9: Odd pixel G data

OB0~OB9 : Odd pixel B data

DE : Data enable signal

DCLK : Data clock signal

Note (1) The system must have the transmitter to drive the module.

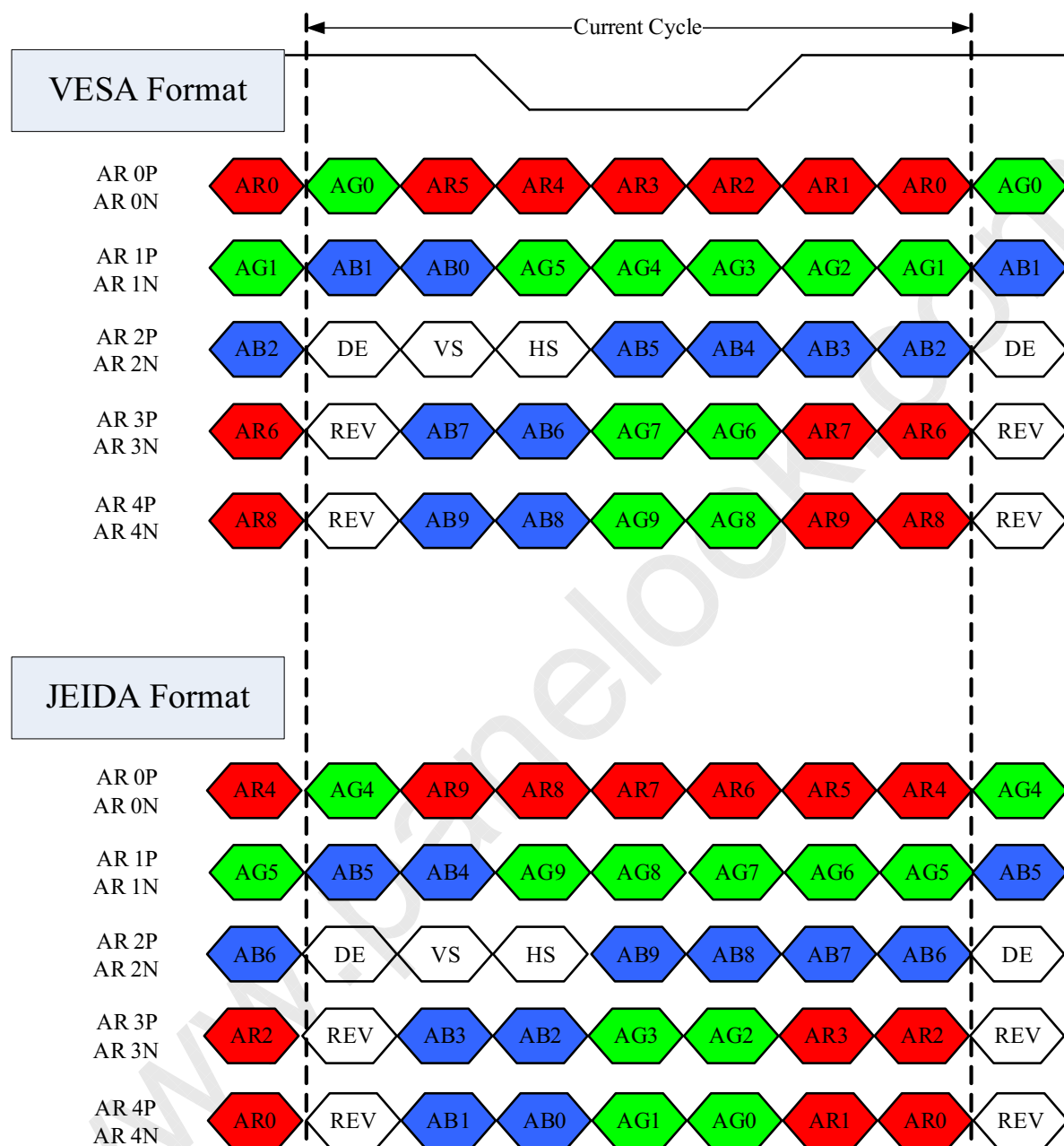
Note (2) LVDS cable impedance shall be 50 ohms per signal line or about 100 ohms per twist-pair line when it is used differentially.

Note (3) Two pixel data send into the module for every clock cycle. The first pixel of the frame is odd pixel and the second pixel is even pixel.

5.4 LVDS INTERFACE

VESA Format : SELLVDS = H or Open

JEIDA Format : SELLVDS = L



AR0~AR9: First Pixel R Data (9; MSB, 0; LSB)

AG0~AG9: First Pixel G Data (9; MSB, 0; LSB)

AB0~AB9: First Pixel B Data (9; MSB, 0; LSB)

DE : Data enable signal

DCLK : Data clock signal

RSVD : Reserved





6. INTERFACE TIMING

6.1 INPUT SIGNAL TIMING SPECIFICATIONS

The input signal timing specifications are shown as the following table and timing diagram.

Signal	Item	Symbol	Min.	Typ.	Max.	Unit	Note
LVDS Receiver Clock	Frequency	1/Tc	-	74	-	MHz	
Hsync		Fh	-	67.5	-	KHz	
Vsync		Fv	-	59.94	-	Hz	
LVDS Receiver Data	Setup Time	Tlvsu	600	-	-	ps	
	Hold Time	Tlvhd	600	-	-	ps	
Vertical Active Display Term	Frame Rate	Fr6	57	60	63	Hz	
	Total	Tv	(TBD)	1125	(TBD)	Th	Tv=Tvd+Tvb
	Display	Tvd	(TBD)	1080	(TBD)	Th	-
	Blank	Tvb	(TBD)	45	(TBD)	Th	-
Horizontal Active Display Term	Total	Th	(TBD)	2200	(TBD)	Tc	Th=Thd+Thb
	Display	Thd	(TBD)	1920	(TBD)	Tc	-
	Blank	Thb	(TBD)	280	(TBD)	Tc	-

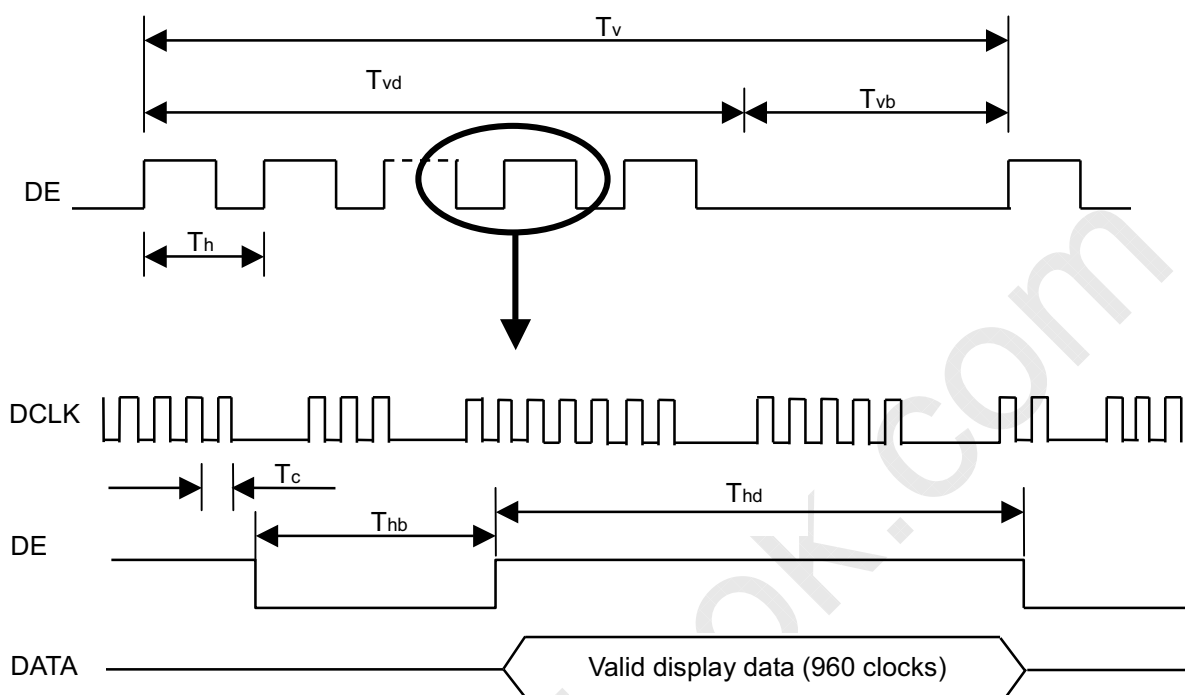
6.2 INTERNAL SIGNAL TIMING SPECIFICATIONS (FRC→ T-CON)

The input signal timing specifications are shown as the following table and timing diagram.

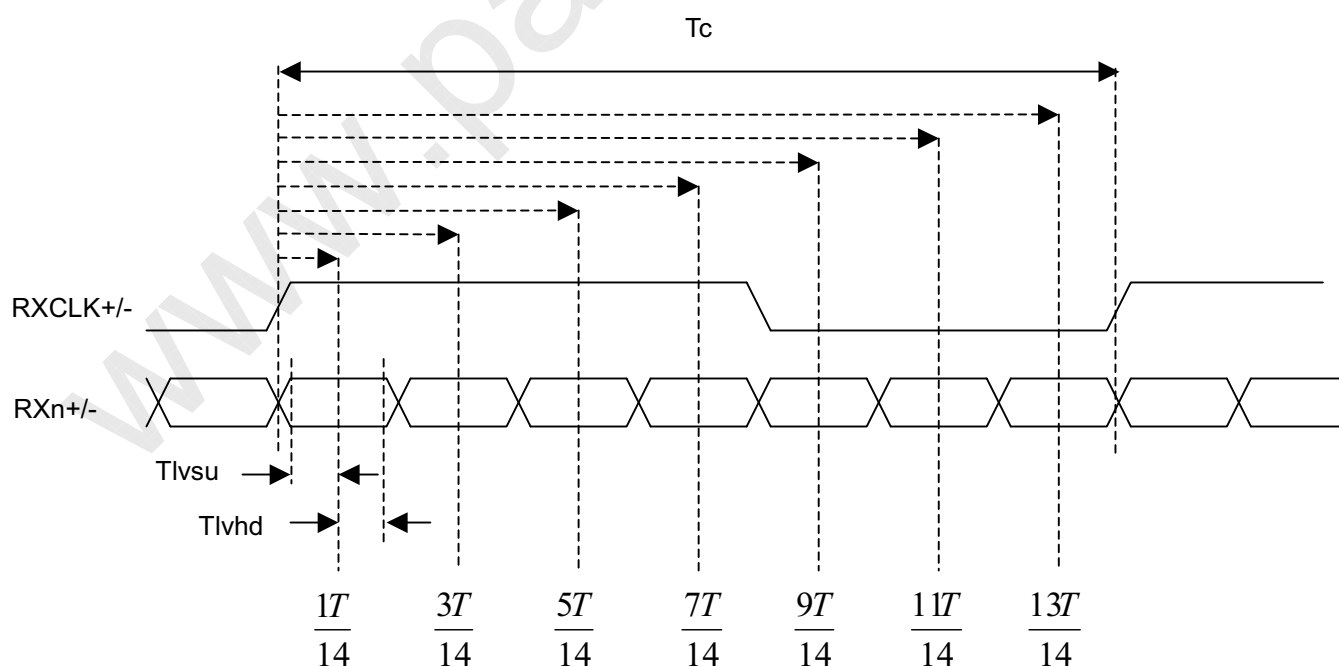
Signal	Item	Symbol	Min.	Typ.	Max.	Unit	Note
LVDS Receiver Clock	Frequency	1/Tc	60	74	80	MHz	
Hsync		Fh	-	135	-	KHz	
Vsync		Fv	-	120	-	Hz	
LVDS Receiver Data	Setup Time	Tlvsu	600	-	-	ps	
	Hold Time	Tlvhd	600	-	-	ps	
Vertical Active Display Term	Frame Rate	Fr6	-	120	-	Hz	
	Total	Tv	1115	1125	1139	Th	Tv=Tvd+Tvb
	Display	Tvd	1080	1080	1080	Th	-
	Blank	Tvb	35	45	59	Th	-
Horizontal Active Display Term	Total	Th	540	550	575	Tc	Th=Thd+Thb
	Display	Thd	480	480	480	Tc	-
	Blank	Thb	60	70	95	Tc	-

. Note : Since the module is operated in DE only mode, Hsync and Vsync input signals should be set to low logic level. Otherwise, this module would operate abnormally.

INPUT SIGNAL TIMING DIAGRAM

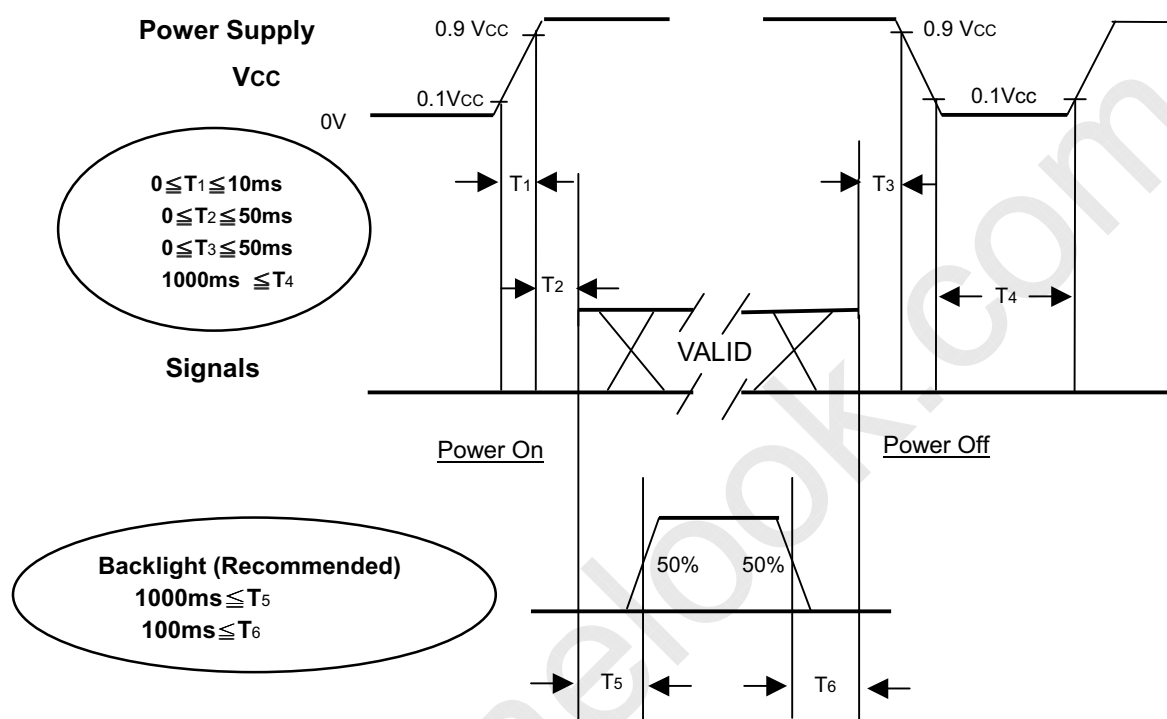


LVDS RECEIVER INTERFACE TIMING DIAGRAM



6.3 POWER ON/OFF SEQUENCE

To prevent a latch-up or DC operation of LCD module, the power on/off sequence should be as the diagram below.



Power ON/OFF Sequence

Note (1) The supply voltage of the external system for the module input should follow the definition of Vcc.

Note (2) Apply the lamp voltage within the LCD operation range. When the backlight turns on before the LCD operation or the LCD turns off before the backlight turns off, the display may momentarily become abnormal screen.

Note (3) In case of Vcc is in off level, please keep the level of input signals on the low or high impedance.

Note (4) T4 should be measured after the module has been fully discharged between power off and on period.

Note (5) Interface signal shall not be kept at high impedance when the power is on.

7. OPTICAL CHARACTERISTICS

7.1 TEST CONDITIONS

Item	Symbol	Value	Unit
Ambient Temperature	Ta	25±2	°C
Ambient Humidity	Ha	50±10	%RH
Supply Voltage	V _{CC}	12	V
Input Signal	According to typical value in "3. ELECTRICAL CHARACTERISTICS"		
Lamp Current(HV)	I _L	8.0 ± 0.3	mA
Oscillating Frequency (Balance Board)	F _w	48±3	KHz
Frame rate		60	Hz

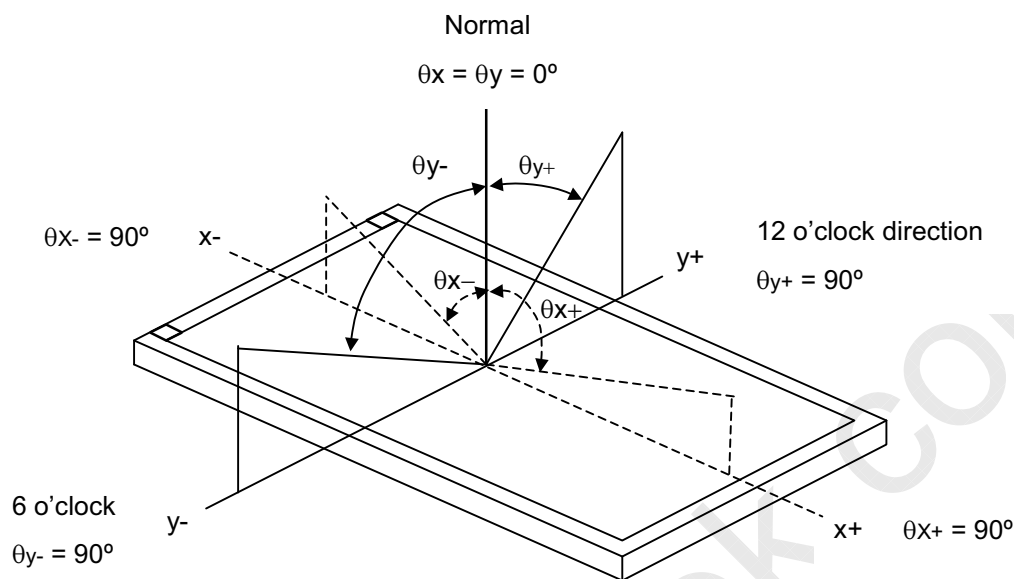
7.2 OPTICAL SPECIFICATIONS

The relative measurement methods of optical characteristics are shown in 7.2. The following items should be measured under the test conditions described in 7.1 and stable environment shown in Note (6).

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note				
Contrast Ratio		CR	$\theta_x=0^\circ, \theta_Y=0^\circ$ Viewing angle at Normal direction	4000	5000	-	-	(2)				
Response Time		Gray to gray average		-	6.5	12	ms	(3)				
Center Luminance of White		L _c		450	500	-	cd/	(4)				
White Variation		δW		-	-	1.3	-	(7)				
Cross Talk		CT		-	-	4.0	%	(5)				
Color Chromaticity	Red	R _x		Typ. - 0.03	0.635 0.323 0.285 0.602 0.148 0.056 0.280 0.290	Typ. + 0.03	-	(6)				
		R _y					-					
	Green	G _x					-					
		G _y					-					
	Blue	B _x					-					
		B _y	-									
	White	W _x	-									
		W _y	-									
	Color Gamut		CG				70		72		%	NTSC
	Viewing Angle	Horizontal	θ_{x+}				CR $\geq$ 20		80	88	-	Deg .
θ_{x-}			80	88	-							
Vertical		θ_{Y+}	80	88	-							
		θ_{Y-}	80	88	-							

Note (1) Definition of Viewing Angle (θ_x , θ_y):

Viewing angles are measured by EZ-Contrast 160R (Eldim)



Note (2) Definition of Contrast Ratio (CR):

The contrast ratio can be calculated by the following expression.

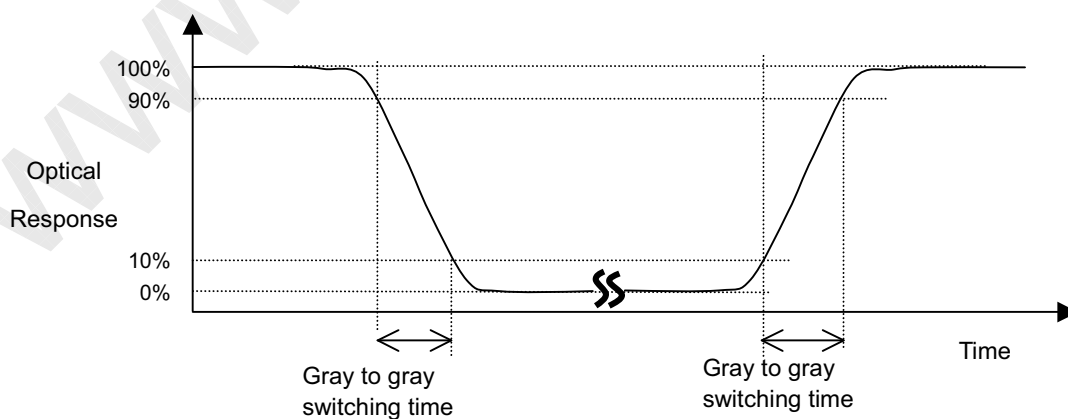
$$\text{Contrast Ratio (CR)} = L_{255} / L_0$$

L255: Luminance of gray level 255

L 0: Luminance of gray level 0

CR = CR (5), where CR (X) is corresponding to the Contrast Ratio of the point X at the figure in Note (7).

Note (3) Definition of Gray to Gray Switching Time :



The driving signal means the signal of gray level 0, 63, 127, 191, 255.

Gray to gray average time means the average switching time of gray level 0, 63, 127, 191, 255 to each other.

Note (4) Definition of Luminance of White (L_C , L_{AVE}):

Measure the luminance of gray level 255 at center point and 5 points

$$L_C = L(5)$$

$$L_{AVE} = [L(1) + L(2) + L(3) + L(4) + L(5)] / 5$$

where $L(x)$ is corresponding to the luminance of the point x at the figure in Note (7).

Note (5) Definition of Cross Talk (CT):

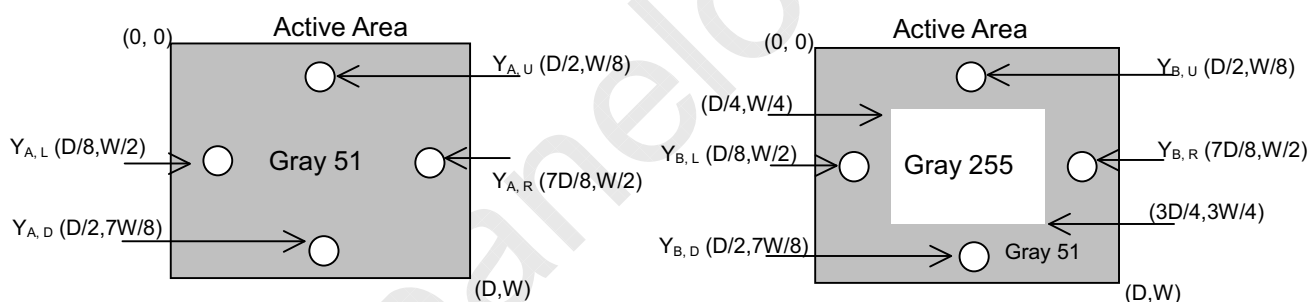
$$CT = |Y_B - Y_A| / Y_A \times 100 (\%)$$

Where:

(a)

Y_A = Luminance of measured location without gray level 255 pattern (cd/m^2)

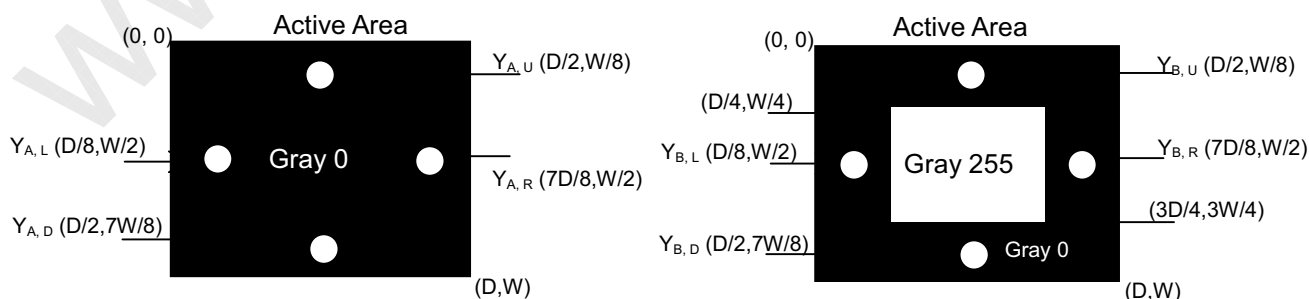
Y_B = Luminance of measured location with gray level 255 pattern (cd/m^2)



(b)

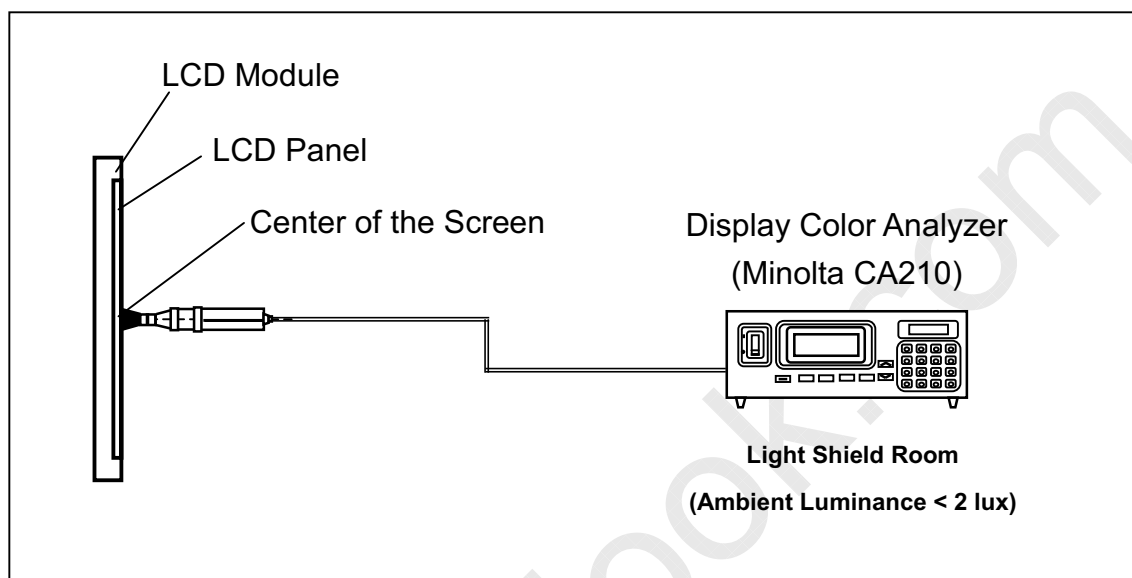
Y_A = Luminance of measured location without gray level 255 pattern (cd/m^2)

Y_B = Luminance of measured location with gray level 255 pattern (cd/m^2)



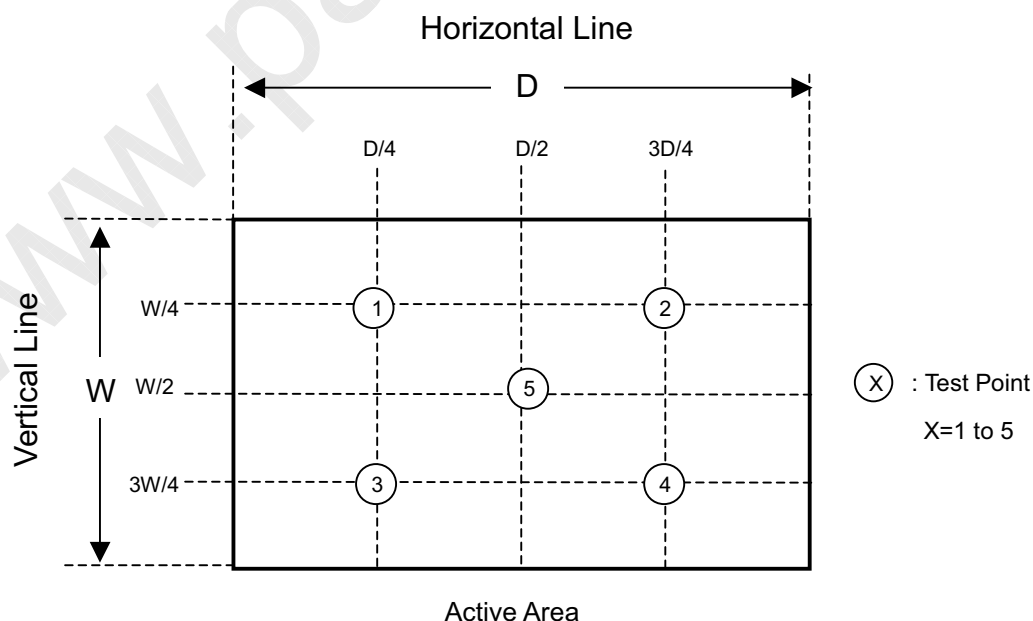
Note (6) Measurement Setup:

The LCD module should be stabilized at given temperature for 1 hour to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting Backlight for 1 hour in a windless room.


Note (7) Definition of White Variation (δW):

Measure the luminance of gray level 255 at 5 points

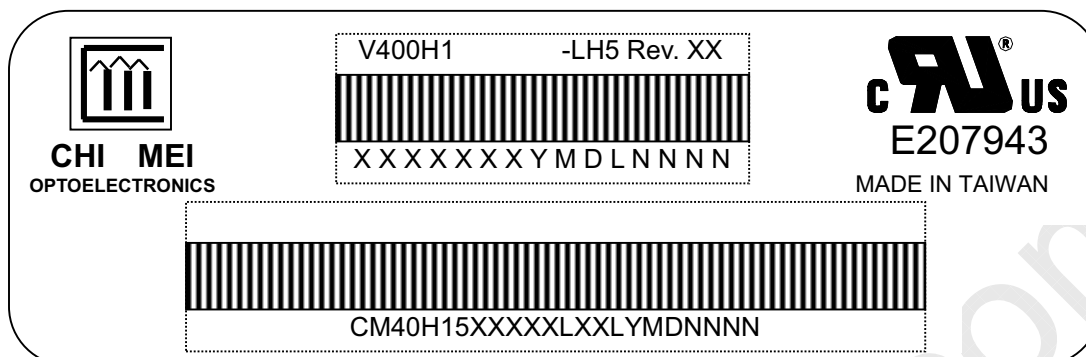
$$\delta W = \text{Maximum} [L(1), L(2), L(3), L(4), L(5)] / \text{Minimum} [L(1), L(2), L(3), L(4), L(5)]$$



8. DEFINITION OF LABELS

8.1 CMO MODULE LABEL

The barcode nameplate is pasted on each module as illustration, and its definitions are as following explanation.



- (a) Model Name: V400H1-LH5
 (b) Revision: Rev. XX, for example: A0, A1... B1, B2... or C1, C2...etc.
 (c) CMO barcode definition:

Serial ID: XX-XX-X-XX-YMD-L-NNNN

Code	Meaning	Description
XX	CMO internal use	-
XX	Revision	Cover all the change
X-XX	CMO internal use	-
YMD	Year, month, day	Year: 2001=1, 2002=2, 2003=3, 2004=4... Month: Jan. ~ Dec.=1, 2, 3, ~, 9, A, B, C Day: 1 st to 31 st =1, 2, 3, ~, 9, A, B, C, ~, W, X, Y, exclude I, O, and U
L	Product line #	Line 1=1, Line 2=2, Line 3=3, ...
NNNN	Serial number	Manufacturing sequence of product

- (d) Customer's barcode definition:

Serial ID: CM-40H15-X-X-X-XX-L-XX-L-YMD-NNNN

Code	Meaning	Description
CM	Supplier code	CMO=CM
40H15	Model number	V400H1-LH5=40H15
X	Revision code	C1=A, C2=B,C9=I
X	Source driver IC code	Century=1, CLL=2, Demos=3, Epson=4, Fujitsu=5, Himax=6, Hitachi=7, Hynix=8, LDI=9, Matsushita=A, NEC=B, Novatec=C, OKI=D, Philips=E, Renasas=F, Samsung=G, Sanyo=H, Sharp=I, TI=J, Topro=K, Toshiba=L, Windbond=M
X	Gate driver IC code	
XX	Cell location	Tainan, Taiwan=TN
L	Cell line #	1~12=0~C
XX	Module location	Tainan, Taiwan=TN
L	Module line #	1~12=0~C
YMD	Year, month, day	Year: 2001=1, 2002=2, 2003=3, 2004=4... Month: Jan. ~ Dec.=1, 2, 3, ~, 9, A, B, C Day: 1 st to 31 st =1, 2, 3, ~, 9, A, B, C, ~, W, X, Y, exclude I, O, and U
NNNN	Serial number	By LCD supplier

9. PACKAGING

9.1 PACKING SPECIFICATIONS

- (1) 4 LCD TV modules / 1 Box
- (2) Box dimensions : 1040(L) X 310 (W) X 640(H)
- (3) Weight : approximately 47Kg (4 modules per box)

9.2 PACKING METHOD

Figures 9-1 and 9-2 are the packing method

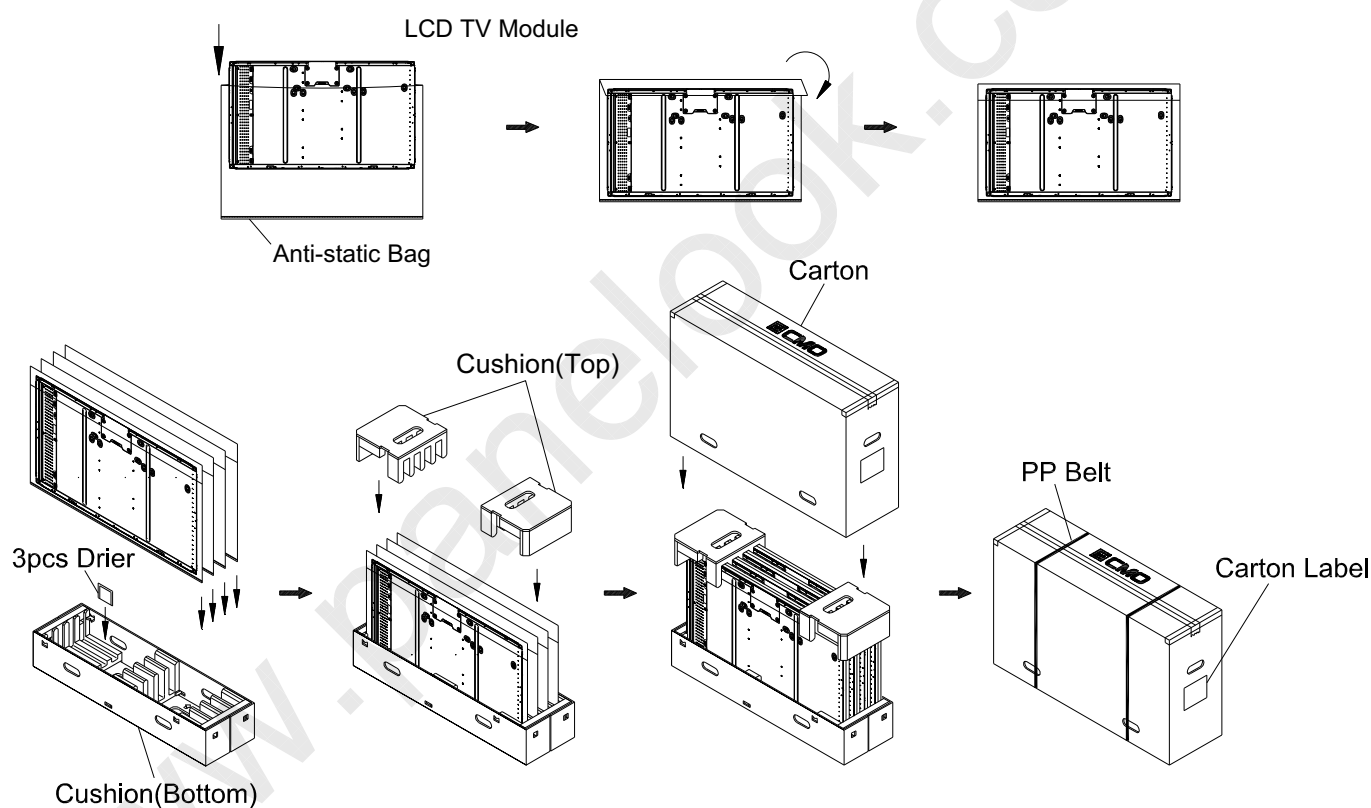
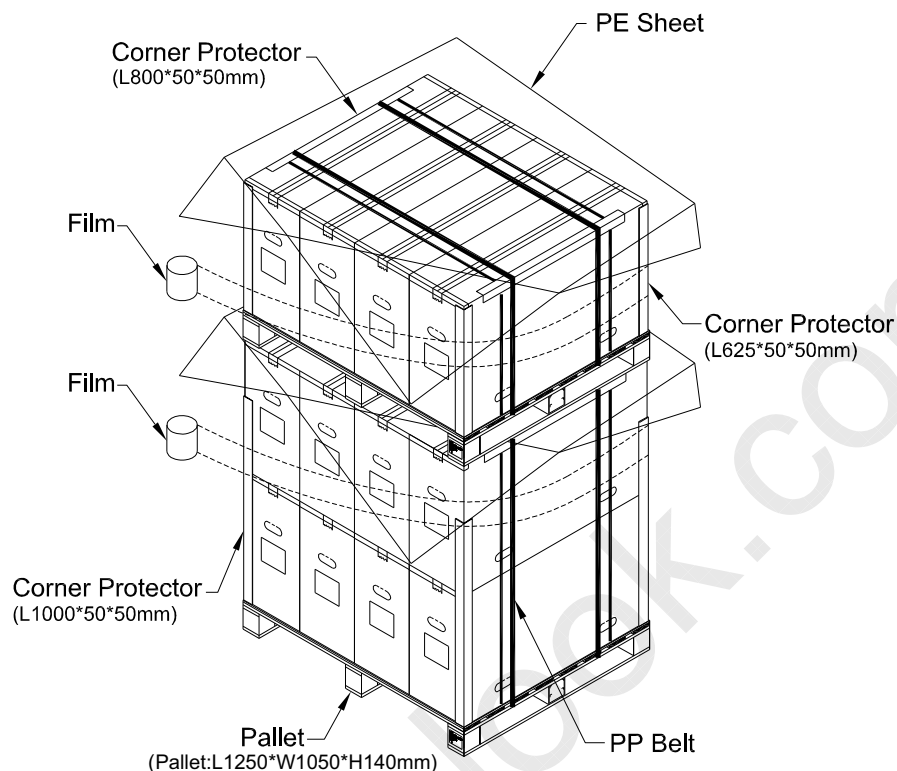


Figure.9-1 packing method



Sea / Land Transportation (40ft Container)



Air Transportation

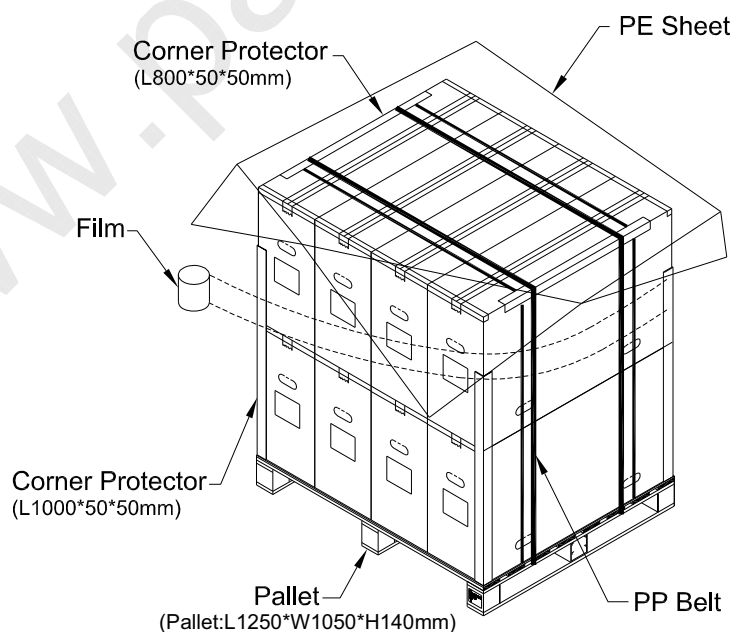


Figure. 9-2 Packing method

10. PRECAUTIONS

10.1 ASSEMBLY AND HANDLING PRECAUTIONS

- (1) Do not apply rough force such as bending or twisting to the module during assembly.
- (2) It is recommended to assemble or to install a module into the user's system in clean working areas.
The dust and oil may cause electrical short or worsen the polarizer.
- (3) Do not apply pressure or impulse to the module to prevent the damage of LCD panel and backlight.
- (4) Always follow the correct power-on sequence when the LCD module is turned on. This can prevent the damage and latch-up of the CMOS LSI chips.
- (5) Do not plug in or pull out the I/F connector while the module is in operation.
- (6) Do not disassemble the module.
- (7) Use a soft dry cloth without chemicals for cleaning, because the surface of polarizer is very soft and easily scratched.
- (8) Moisture can easily penetrate into LCD module and may cause the damage during operation.
- (9) High temperature or humidity may deteriorate the performance of LCD module. Please store LCD modules in the specified storage conditions.
- (10) When ambient temperature is lower than 10°C, the display quality might be reduced. For example, the response time will become slow, and the starting voltage of CCFL will be higher than that of room temperature.

10.2 SAFETY PRECAUTIONS

- (1) The startup voltage of a backlight is over 1000 Volts. It may cause an electrical shock while assembling with the inverter. Do not disassemble the module or insert anything into the backlight unit.
- (2) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth. In case of contact with hands, skin or clothes, it has to be washed away thoroughly with soap.
- (3) After the module's end of life, it is not harmful in case of normal operation and storage.

10.3 SAFETY STANDARDS

The LCD module should be certified with safety regulations as follows:

- (1) UL60950-1 or updated standard.
- (2) IEC60950-1 or updated standard.
- (3) UL60065 or updated standard.
- (4) IEC60065 or updated standard.

11. MECHANICAL CHARACTERISTICS

